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CRUISE REPORT

R/V GYRE 81-G-12

27 July - 17 August, 1981

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Vessel: R/V GYRE

Cruise Number: 81-G-12

Parent Projects: North Atlantic Environmental Assessment (bottom stability): 9840-51823

Submarine Canyon Dynamics: 9840-52806

Funding Agency: Bureau of Land Management

Funding Amount: Total combined project funds for FY-81: $630,863

Contract Number: Funding provided under MOU #AA851-IA1-17

Contract Start-End Dates: October 1, 1981-September 30, 1981

Area of Operations: a. Continental Slope off Georges Bank: Oceanographer-Lydonia Canyons area ($67^{\circ}15'$ to $68^{\circ}15'$; $39^{\circ}45'$ to $40^{\circ}20'$)

b. Continental Slope in vicinity of Atlantis and Alvin Canyons: ($40^{\circ}00'$ to $39^{\circ}35'$; $70^{\circ}10'$ to $70^{\circ}55'$)

Dates of Start and End of Cruise:

Lv Woods Hole, MA	27 July 1981	1050
Ar Woods Hole, MA	31 July 1981	1800
Lv Woods Hole, MA	3 August 1981	1515
Ar Woods Hole, MA	6 August 1981	0700
Lv Woods Hole, MA	8 August 1981	1205
Ar Woods Hole, MA	17 August 1981	2330

Chief Scientists: Dennis O'Leary, USGS, Woods Hole, MA
Bonnie McGregor, USGS, Fisher Island, Miami FL

Names and Affiliations of Scientific Party:

John Hampson, USGS
Robert Douthart, USGS
Kenneth Parolski, USGS
Kathryn Scanlon, USGS
Carol Parmenter, USGS
Susan Williams, USGS
Wes Lombard, USGS (August 3-6, 1981)
Frank Jennings, USGS (August 3-6, 1981)
Scott Chalker, USGS (August 8-17, 1981)

Names and Affiliations of Scientific party - Continued:

William B.F. Ryan, Lamont-Doherty Geological Observatory (LDGO)
Al Hagan, LDGO
John DiBernardo, LDGO
Jacqueline Hatta, LDGO
Lisa Lottes, LDGO (July 27-August 8, 1981)
Kim Kastens, LDGO (July 27-August 8, 1981)
Anita Brosius, LDGO (July 27-August 8, 1981)
John Farre, LDGO (July 27-August 8, 1981)
Dale Chayes, LDGO (July8 27-August 8, 1981)

Captain: Donald Armand

Purpose of Cruise: To conduct sidescan-sonar surveys of three areas of the Continental Slope cut by major canyons in the vicinity of lease-sale blocks and secondarily to survey these same areas using conventional single-channel seismic-profiling techniques. (The area not surveyed was the Wilmington-Baltimore Canyons area in the mid-Atlantic region)

Navigational Techniques: LORAN-C fixes recorded at 1-minute intervals on magnetic tape, plotted at 10-minute intervals on track chart and at 1-minute intervals on analog X-Y graph plotter.

Scientific Equipment:

1. Sea Marc 1 sidescan-sonar system (27-30 kHz, 4 sec. sweep rate, up to 5 km total swath width, real time slant-range correction for display, circuit board digital azimuth distortion correction manually keyed to recorder speed. 4.5 kHz vehicle echosounder).
2. 3.5 kHz hull-mounted echosounder/subbottom profiler and ORE 140 transceiver.
3. 2 airguns (5-40 in ^{3} chambers)
4. 2 800-joule Teledyne sparkers
5. 200 element hydrophone streamer
6. 40 element Teledyne hydrophone streamer

7. 9 flat-bed paper recorder

8. 1 HP analog 8-channel tape recorder

9. Seismic recording amplifiers, filters, delay box, and air compressor.

Tabulated Information: a. Days at sea - 17

b. Kilometers of trackline data:

sidescan sonar and 3.5 kHz profile (Atlantis-Alvin Canyons area)	375 km
seismic profile (airgun/sparker) and 3.5 kHz (Oceanographer-Lydonia Canyons area)	1,230 km
TOTAL	1,605 km

Comments:

Cruise 81-G-12 was designed with one major objective: to acquire high-resolution "mid-range" sidescan-sonar image data from three areas of the Atlantic Continental Slope/upper rise in which the question of slumping and canyon related processes is of direct concern to petroleum resource development. We were to obtain analog images as well as digital data from which images could be generated and computer enhanced. We also carried our single-channel seismic gear, including the sparker and airgun acoustic power sources and the appropriate electronic signal processing equipment. On board also was Lamont's "Cheep-tow" bottom photography sled and enough color film to conduct an adequate photo survey. The plan was to run the sidescan-sonar survey with concomitant airgun seismic profiles along the sonar track. Should the sonar system fail we were prepared to switch to either a conventional seismic survey, a bottom photography survey, or a combination. We were only partly prepared for what actually happened.

The electric motor for the Scripps winch caught fire on July 28 after 7 hours of use. Nearly 1,400 m of cable and gear were over the side at the time. David Twichell on M/V WHITEFOOT was conducting a survey not far from the GYRE; the WHITEFOOT rendezvoused with GYRE on the night of July 28 to provide us with spare blocks and hawser to facilitate recovery of the cable. We thereupon spent 38 hours hauling in the cable by means of a deck capstan, mooring hawser, and two blocks. The cable was brought in 3 m per pull and hand spooled on the cable drum.

On July 31 R/V GYRE returned to Woods Hole to have the electric motor rebuilt. On August 3 the survey resumed along the slope in the Atlantis-Alvin Canyons area. About 100 km of image data were collected before a hydraulic pump on the winch failed. On August 5 the gear was brought on board by the marginally

operable winch. R/V GYRE returned to Woods Hole on August 6 for emergency pump repair. By August 8 it was clear to us that no repair could be counted on in the forseeable future.

In 13 days only 27 hours of sonar image data had been collected. Furthermore, it came out that the winch had not been properly operated or maintained on earlier cruises, that the liklihood of further malfunctions was not remote, that a questionable cable splice cast a shadow over deep water parts of the survey, and that digital tape data would not be acquired. Because only 9.5 days of survey time remained we were forced to abandon the mid-Atlantic part of the survey. In light of these factors most of the Lamont crew with the exception of Ryan and three others returned to Lamont to begin reducing the data collected, and we brought on two USGS personnel to help conduct a seismic survey.

At 1200 August 8 R/V GYRE proceeded to the Lydonia-Oceanographer Canyons area. We felt that a close seismic survey in this area, extending the network obtained by GYRE 80-G-7 to depths of ~3,000 m would be useful to both the slope stability and the canyon dynamics projects. An excellent seismic survey was completed in 4.7 days using airgun, sparker, and 3.5 kHz profiles at 2 km line spacing.

The seismic data show that the upper rise in the vicinity of Oceanographer-Lydonia Canyons is as precipitous and incised as is the adjacent slope. In fact, most of the incisions into the rise surface are at about the same depth of relief and Lydonia and Oceanographer Canyons are not clearly distinguishable in the high-relief terrain of the upper rise. We are particularly interested in Bear Seamount, which is covered in this survey, because a) it represents a distinct rock type with a distinct form and therefore provides comparative data on deep water erosional processes, b) the nature of its contact with adjacent rise sediments provides information on the mode of deposition and subsequent erosion in adjacent terrain, c) as a well-dated feature it provides a historical reference for erosional history in this part of the Continental Rise.

During the seismic survey, Al Hagan and W.B.F. Ryan repaired the winch hydraulic pump; the problem turned out to be a defective check valve and the pump was made operable because the defective valve could be exchanged for a less critical valve from elsewhere in the hydraulic system. The winch was tested in transit to the Atlantis-Alvin Canyons area. In the remaining three days of the cruise an excellent sonar survey of the slope between and adjacent to Atlantis and Alvin Canyons was completed, including lines along the canyon axes. The analog images include a bottom profile along the image track and have very limited spatial distortion because of improved chart-speed controls which could be closely coordinated to ship speed.

The images show that the slope in the Alvin-Atlantis Canyons area is distinctly different from that of the

Oceanographer-Lydonia Canyons area. The surface is essentially undissected but is cut out by various kinds of slides and shallow slumps. Longitudinal scarps seem to be the most characteristic forms in this area. Both Alvin and Atlantis Canyons are wide, flat-bottomed troughs with simple, embayed margins; the ridge and gully tributary terrain is not present, but local lateral incision seems to reflect fracture control. Images of the canyon mouths on the rise show apparent multiple debris flows and truncated forms. There is some evidence for recent (i.e., post-Pleistocene) sliding on the upper slope. The image data not only corroborate structural interpretations of seismic data previously acquired by this project, they extend the applicability of the seismic interpretations over a broad area, and resolve a number of interpretational ambiguities.